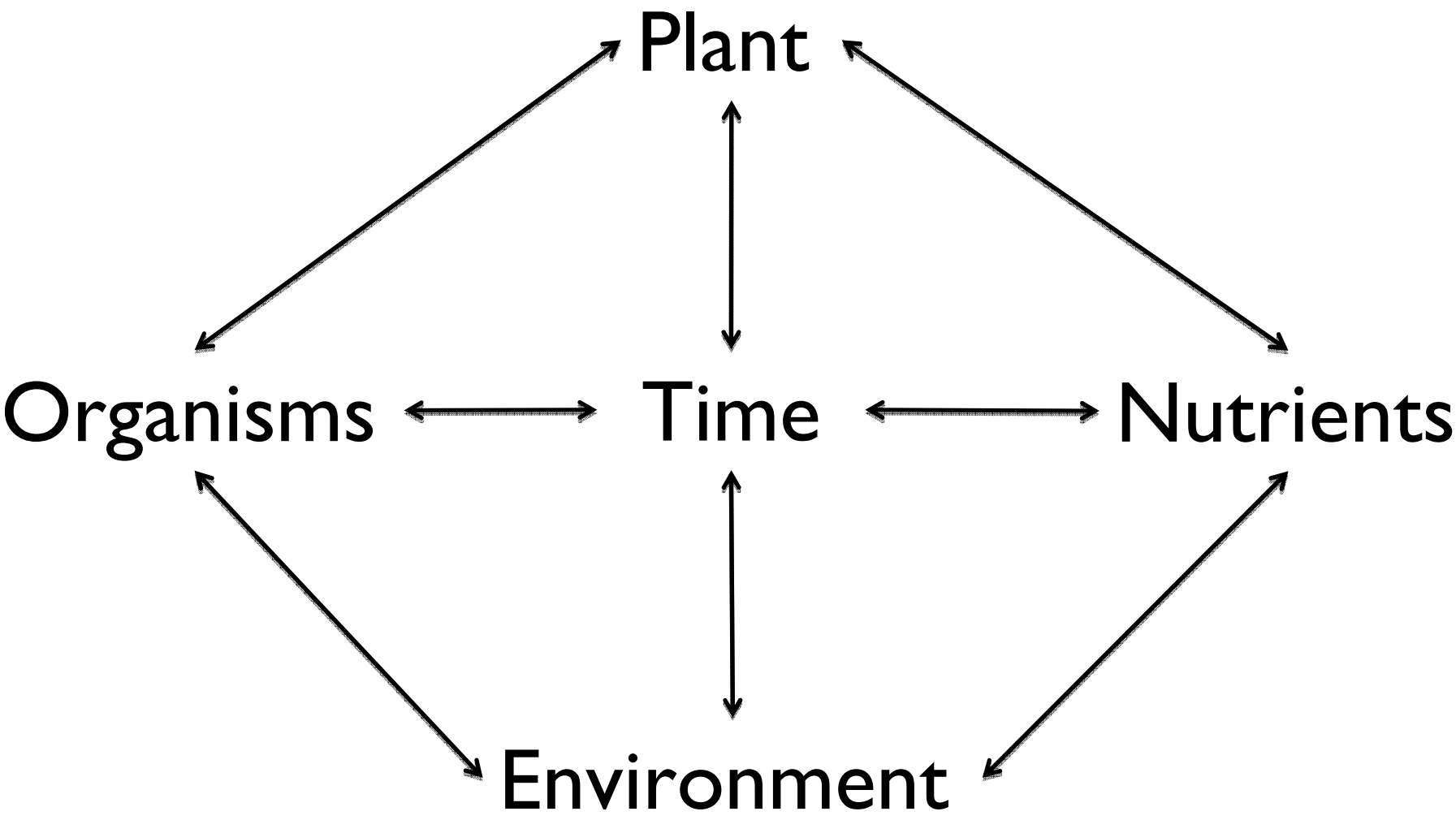
Relationship between pests and diseases and plant nutrition

Managing pests/diseases/yields by optimal fertilisation of crops

Ronald A. Bosch

Outline:



Experience gained in tropical agriculture:

- Banana [*Musa* spp.]
- Pineapple [*Ananas comosus*]
- Cacao [*Theobroma cacao*]

- Postharvest diseases

Banana [*Musa* spp.]

- Fusarium wilt

  [*Fusarium oxysporum f.sp. cubense*]

Banana [*Musa* spp.]

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- Fusarium wilt
  [*Fusarium oxysporum f.sp. cubense*]

- High P (soil) → lower Zn absorption → low resistance to Fusarium wilt

- Mind N:K-ratio

Banana [*Musa* spp.]

- Moko disease

  [*Ralstonia solanacearum* Race 2, Biovar 1]

Banana [*Musa* spp.]

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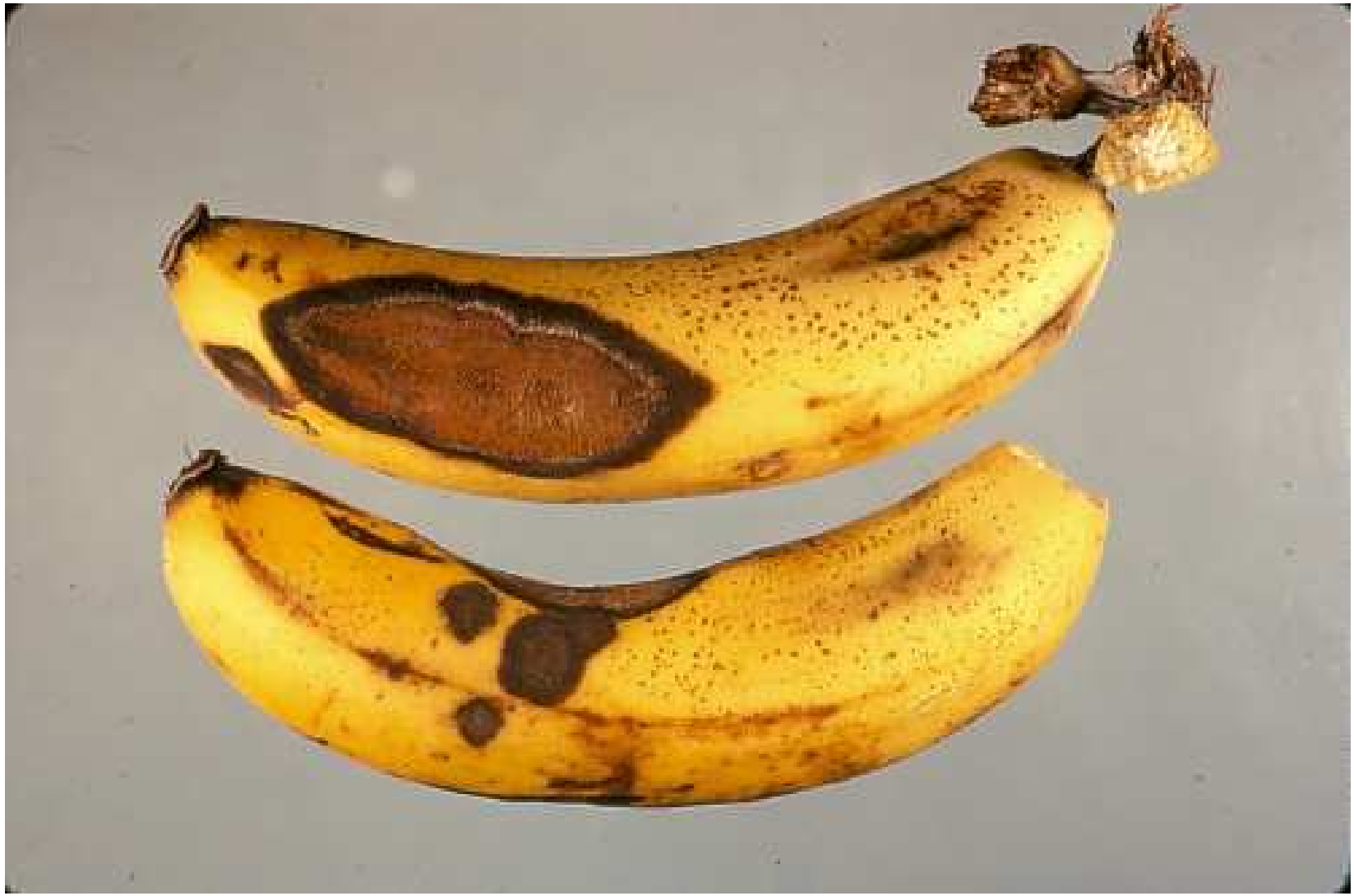
- Moko disease
  [*Ralstonia solanacearum* Race 2, Biovar 1]

- High K → suppress bacterial diseases

Banana [*Musa* spp.]

- Anthracnose
  [*Colletotrichum musae*]

Banana [*Musa* spp.]



Banana [*Musa* spp.]

- Anthracnose
  [*Colletotrichum musae*]

- Mn available → decrease anthracnose

Pineapple [*Ananas comosus*]

- Root rot

  [*Phytophthora cinnamomi*]

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- Root rot
  [*Phytophthora cinnamomi*]

- K available → decrease root rot

Cacao [*Theobroma cacao*]

- Vascular wilt

  [*Verticillium dahliae*]

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- High S (vascular tissue) → toxic to fungus

Postharvest diseases

- Strawberry → *Botrytis cinerea*

Postharvest diseases

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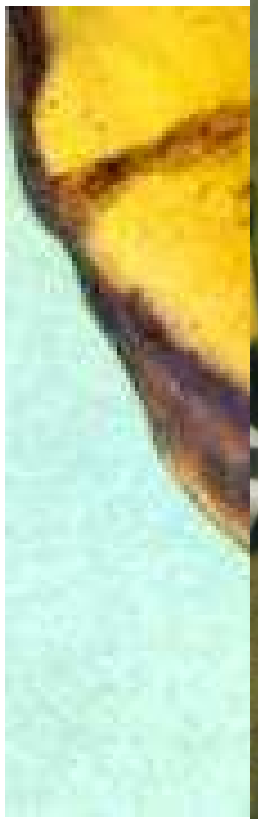
- Strawberry → *Botrytis cinerea*

- Banana → *Glomerella cingulata*

Postharvest diseases



Postharvest diseases

- Strawberry → *Botrytis cinerea*
- Banana → *Glomerella cingulata*
- Orange → *Penicillium expansum*
  Penicillium digitatum

Postharvest diseases

Postharvest diseases

- Strawberry → *Botrytis cinerea*
- Banana → *Glomerella cingulata*
- Orange → *Penicillium expansum*
  Penicillium digitatum
- Peach → *Monilinia fructicola*

Postharvest diseases

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Calcium is important:

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- Normal compound of cell wall and middle lamina

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- Inactivate fungal toxins

Postharvest diseases

Calcium is important:

- Normal compound of cell wall and middle lamina
- Inactivate fungal toxins
- Regulation of phytoalexin synthesis

Postharvest diseases

Calcium increase in plant:

- Fertilizer applications → increase soil pH

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Postharvest diseases

Calcium increase in plant:

- Fertilizer applications → increase soil pH
- High pH → slow fungal growth (low Fe and B)
- Bio-control agents overcome toxic effect
- High Ca effects:
  - Fruit firmness
  - Reduce pathogen incidence
  - Delay ripening

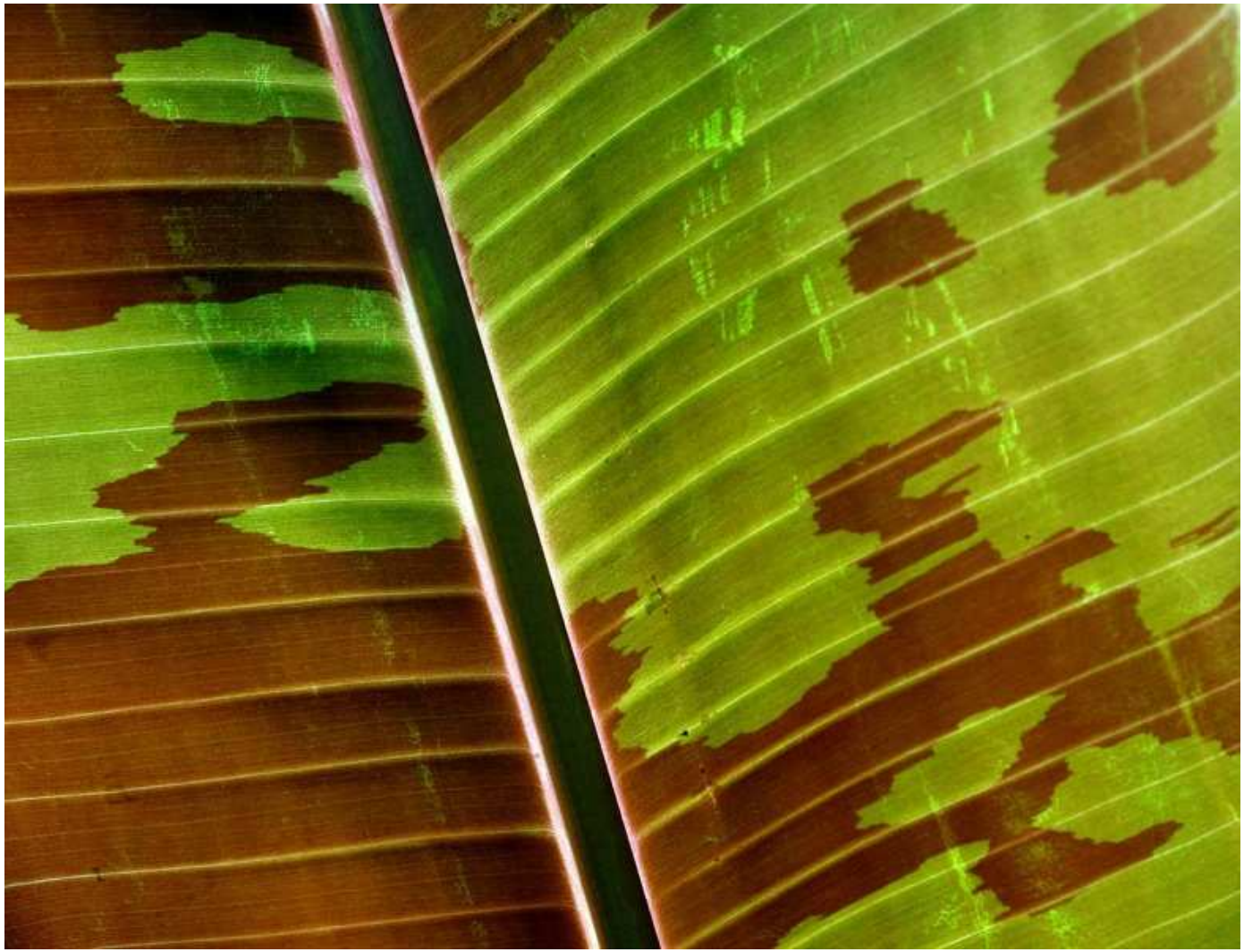
Banana [*Musa* spp.]

- Anthracnose (postharvest disease) [*Colletotrichum musae*]
- Apply Ca to the soil (roots) → Faster…?
- Foliar application: compost tea…?

Banana [*Musa* spp.]

1. Collection
2. Filtration
3. Application

Banana [*Musa* spp.]



Fertalisation banana

- Foliar application (only micro-nutrients)

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- Compost and bokashi

Fertalisation banana

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- Foliar application (only micro-nutrients)
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- Ash

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- Chicken manure

Fertalisation banana

- Foliar application (only micro-nutrients)
- Compost and bokashi
- Ash
- Chicken manure
- Cover crops

Fertalisation banana

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Fertalisation banana

- Foliar application (only micro-nutrients)
- Compost and bokashi
- Ash
- Chicken manure
- Cover crops/mulch
- No bush fires

Fertalisation banana

Fertalisation banana

- Foliar application (only micro-nutrients)
- Compost and bokashi
- Ash
- Chicken manure
- Cover crops/mulch
- No bush fires
- Mycorrhiza

Fertalisation banana

Foliar application (Ghana)

Daily Graphic, Monday, July 27, 2009. NEWS 21

'Use more liquid fertilisers'

Story: Kweku Tsen

PROFESSOR Nii Noi Dowuona, head of the Soil Science Department of the School of Agriculture of the University of Ghana has recommended the regular use of liquid fertilisers by Ghanaian farmers to maximise food production in the country.

He explained that the use of liquid fertilisers manufactured and distributed in the country by companies such as the Sidalco Company Limited had the potential to address the perennial shortage of food in the country.

Prof. Dowuona told the *Daily Graphic* in Accra that the country could save the scarce foreign exchange reserves which it utilises on an annual basis to import food items to augment shortages in the country.

He commended the chairman of the company, Mr David Lamptey for his ingenuity which had culminated in the manufacturing of the liquid fertilisers, which he said, would also boost cocoa production and increase the income of practitioners in the cocoa industry.

" The appreciation in the real income of farmers in the cocoa industry and those engaged in cereal and vegetable farming would undoubtedly attract more people especially the youth to agriculture, thereby reducing the rate of unemployment in the country," Prof. Dowuona said.

The University of Ghana don who was commenting on the potential and efficacy of the Sidalco liquid fertilisers and its multiple use in the agriculture industry, said the proper application of the fertilisers to cocoa will enable Ghana to reclaim its position as the world's leading producer of the crop with the passage of time.

Explaining further the benefits of the liquid fertilisers of the company, Prof. Dowuona said the superiority of the product over other kinds of fertilisers had never been in doubt, since they were excellent sources of macro and micro nutrients.

He further explained that the liquid fertilisers had a greater latitude of application since it could be used under different climatic situations , whether in drought stricken areas or areas which experienced torrential rainfall.

According to Prof. Dowuona, the liquid fertilisers as compared with other forms had also minimal wastage and low losses of farm produce.

" The need to provide additional nutrients to ensure high food production is indisputable and for which the Sidalco liquid fertilisers had been introduced at the appropriate time on the Ghanaian market to address problems associated with obtaining high crop yields by farmers," he said.

The University of Ghana don remarked that notwithstanding the high cost of other kinds of fertilisers , it had been established that nutrients that were applied may not achieve the objectives of high food production because of losses from leaching.

" The lost fertilisers in the form of nitrate in soils may contaminate underground waters which serves as sources of potable water to the broad masses of the people especially those in the rural communities," he said.

The liquid fertilisers , Prof. Dowuona noted, ensured no leaching of nitrates , avoided contaminating water sources and did not increase soil acidity or degradation.

He added that another advantage of the liquid fertilisers was that it was not bulky and could be transported over long distances for minimal fee as compared with the normal fertilisers which attracted higher fares from transport owners.

Prof. Dowuona recommended the liquid fertilisers to the Ministry of Agriculture and the Ghana Cocoa Board, stressing that its usage could revolutionarise food production in the country and reduce the country's over-dependence on food hand-outs to the developed economies.

"Nature has endowed the country with fertile soils and massive water bodies and now we have been blessed with the availability of liquid fertilisers which could be used in the farming industry to increase food production at reasonable prices for the masses," he said.

Prof. Nii Noi Dowuona; University of Ghana

Daily Graphic; 27-07-2009

Foliar application (Ghana)

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- Dry areas or high rainfall areas
- Minimal wastage (soil water)
- Low losses (leaching)
- High yields *(Theobroma cacao)*
- No increase soil acidity, no soil degradation
- Easy transportation

Consultancy pineapple farm

- Drought

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- Drought
- Root system (pathogens)

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- Fruit protection

Consultancy pineapple farm

- Drought
- Root system (pathogens)
- Nutrients relocate difficultly within the plant
- Corrective measures
- Fruit protection
- Synchronisation

Foliar application: Yes, but……

- Availability of water (quality)

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- Fertiliser dissolves in water (fertigation)

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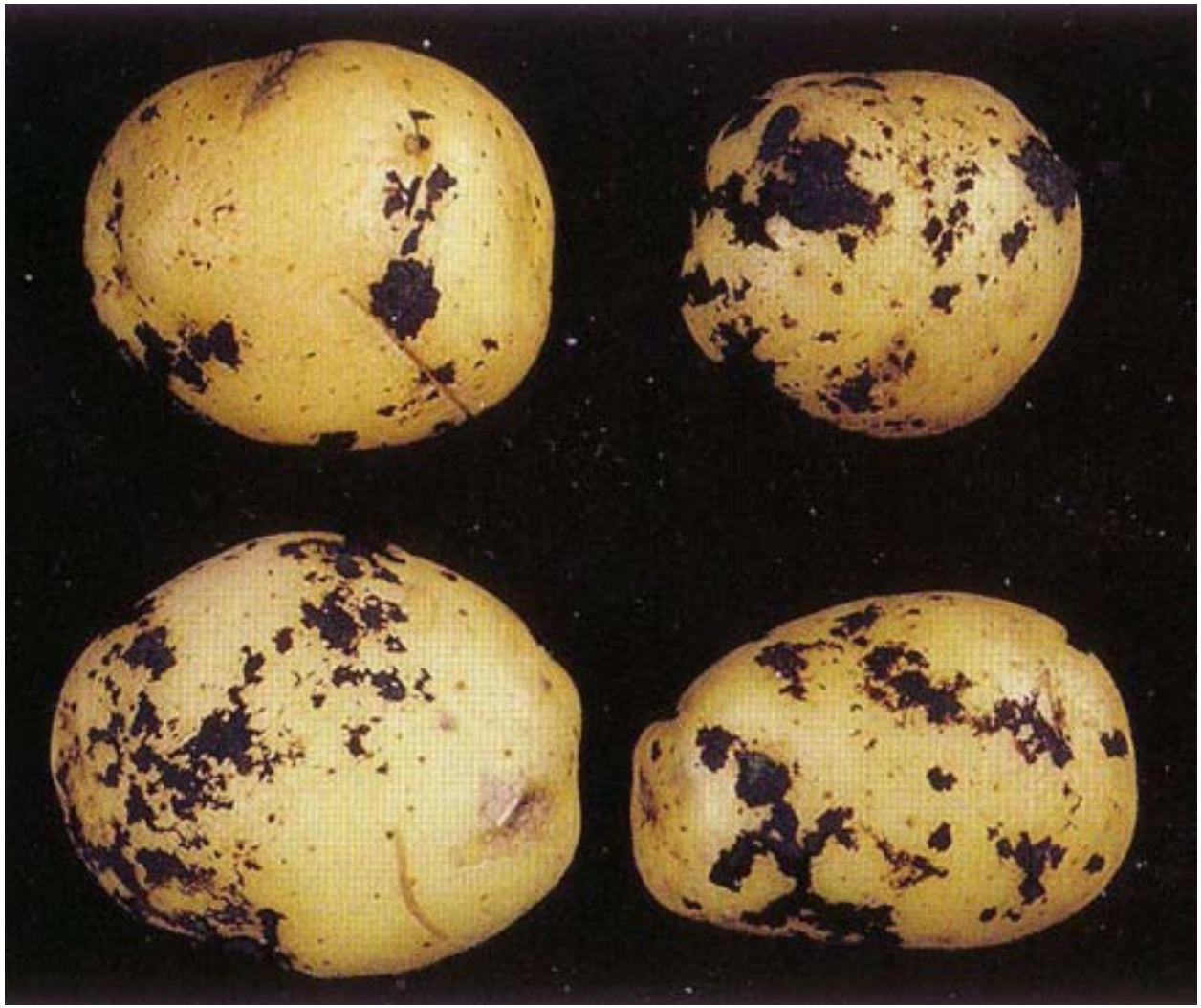
- Availability of water (quality)
- Fertiliser dissolves in water (fertigation)
- Only micro-nutrients
- Leaf damage (dry and hot conditions)
- Use leaf and soil analysis
- Disease pressure

Netherlands:

Potato [*Solanum tuberosum*]:

- Rhizoctonia
- Early blight
- Bacterial wilt
- Scab
- Wart disease
- Late blight
- Gangrene
- Tuber rot
- Wilt

Rhizoctonia [*Rhizoctonia solani*]



- N
- K
- S
- Mn
- Cu

Common scab [*Streptomyces scabies*]
Powdery scab [*Spongospora subterranea*]

- N
- S
- Mn
- Zn
- Al

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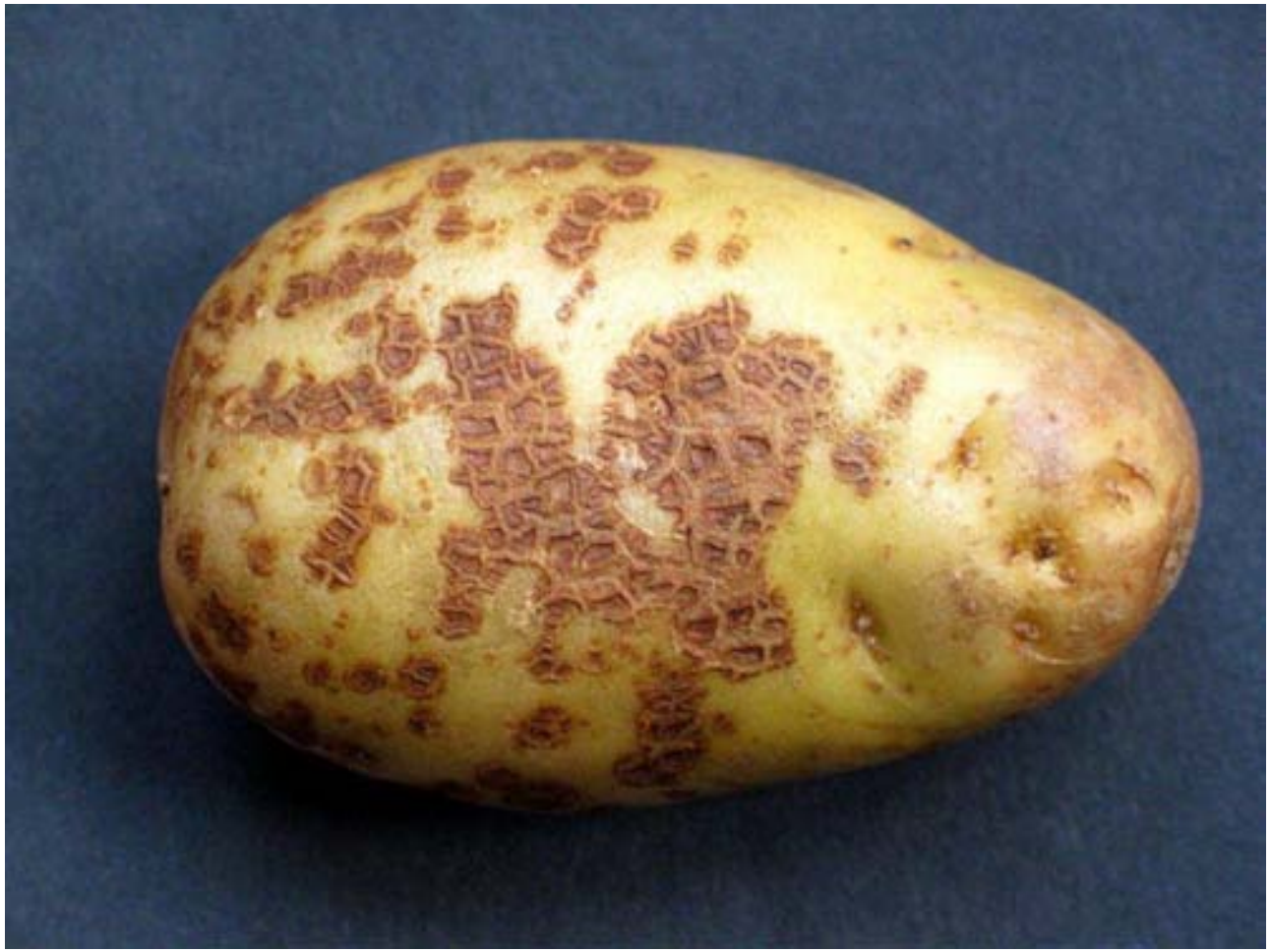


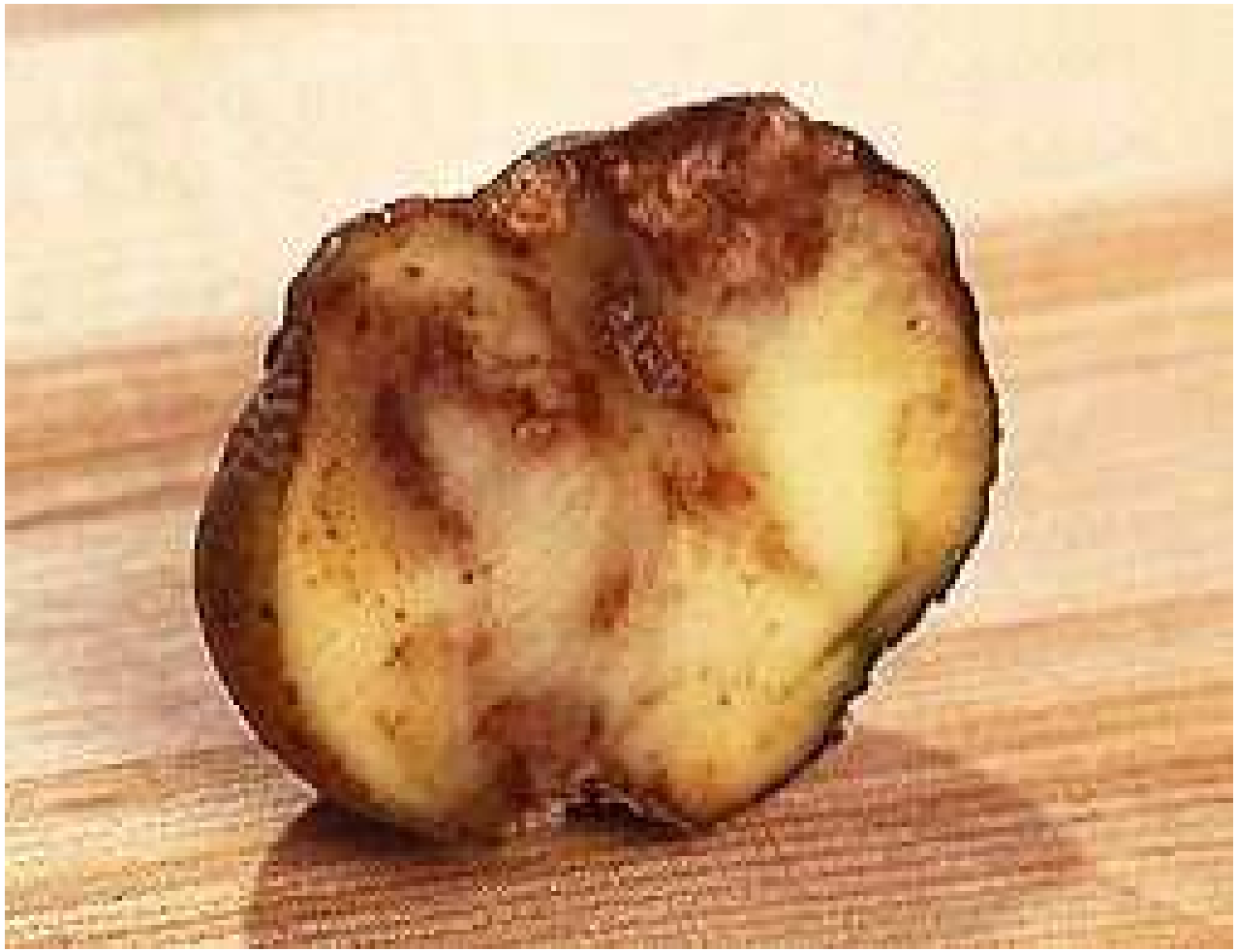
- K
- P

- Mg

Late blight [*Phytophthora infestans*]

- P
- K
- Mn
- Zn
- Cu
- Mo
- S
- AL

Late blight [*Phytophthora infestans*]



- P
- K

Bacteria wilt [*Pectobacterium* spp.]

- P
- K
- Mg
- Ca

Early blight [*Alternaria solani*]

- N
- Cu

Dry rot [*Fusarium* spp.]

- K
- Mg
- Al

Gangrene [*Phoma foveata*]

- Mg

Wilt [*Verticillium dahliae*]

- N
- Mn

Wart disease [*Synchytrium endobioticum*]

- B

Interpretation:

- Species or varieties (host/pathogen)

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- Soil type and structure (chemistry)
- Weeds, cover crops, legumose
- Weather and irrigation

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- Fertilisation, compost, etc.

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- Weeds, cover crops, legumose
- Weather and irrigation
- Fertilisation, compost, etc.
- Sampling and analysis
- Management

Results SPNA:

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  - Espo Microtop in winter wheat: small yield increment
- Foliar vs soil: soil higher yields
- Some fertilzers have effect on scab (pH)

Thank you…